

ME 8: Containerization and Docker

Exercise 3: Building images

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I. Getting setup

```
tingcap@DESKTOP-GCII9EB MINGW64 ~
$ docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
tingcap@DESKTOP-GCII9EB MINGW64 ~
$ docker pull ubuntu:16.04
16.04: Pulling from library/ubuntu
80bce60046fa: Pulling fs layer
55a738a15540: Pulling fs layer
e19cf0706c62: Pulling fs layer
de4cdd6c27d1: Pulling fs layer
de4cdd6c27d1: Waiting
55a738a15540: Download complete
e19cf0706c62: Verifying Checksum
e19cf0706c62: Download complete
de4cdd6c27d1: Download complete
80bce60046fa: Verifying Checksum
80bce60046fa: Download complete
80bce60046fa: Pull complete
55a738a15540: Pull complete
e19cf0706c62: Pull complete
de4cdd6c27d1: Pull complete
Digest: sha256:9775877f420d453ef790e6832d77630a49b32a92b7bedf330adf4d8669f6600e
Status: Downloaded newer image for ubuntu:16.04
docker.io/library/ubuntu:16.04
tingcap@DESKTOP-GCII9EB MINGW64 ~
$ docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
ubuntu        16.04     9ff95a467e45   3 weeks ago    135MB
```

II. Creating a Dockerfile

```
Dockerfile
1 FROM ubuntu:16.04
2 LABEL author="David Elner"
3
4 RUN apt-get update
5
6 RUN apt-get install -y iputils-ping
```

III. Building the Dockerfile

```

tingc@DESKTOP-GCII9EB MINGW64 ~
$ docker build -t 'delner/ping' ./
#2 [internal] load .dockerignore
#2 sha256:b8d4e36264cbd72e590f4059bfa329808f4a8c309d40b2857c5574c01126913
#2 transferring context:
#2 transferring context: 2B 0.0s done
#2 ...

#1 [internal] load build definition from Dockerfile
#1 sha256:b0c1ed3fe0a40ea140a83034cb3141cf4a2ae5495cb90e1ebe085cc4556c21c3
#1 transferring dockerfile: 143B 0.1s done
#1 DONE 1.3s

#2 [internal] load .dockerignore
#2 sha256:b8d4e36264cbd72e590f4059bfa329808f4a8c309d40b2857c5574c01126913
#2 DONE 1.6s

#3 [internal] load metadata for docker.io/library/ubuntu:16.04
#3 sha256:8dff2c23d5907ba94f7c361d130cc16c98c9f3ad54aa1c116e150ea96355a327
#3 DONE 0.0s

#4 [1/3] FROM docker.io/library/ubuntu:16.04
#4 sha256:04187b885604d112762d71717a1346cbc4f17e131fc82857a048019e04951455
#4 DONE 4.8s

#5 [2/3] RUN apt-get update
#5 sha256:d85b94c23f2207314e65c2b65f8174fe8e9f9a171cdda392eb5b3a6093800fe1
#5 1.919 Get:1 http://archive.ubuntu.com/ubuntu xenial InRelease [247 kB]
#5 1.939 Get:2 http://security.ubuntu.com/ubuntu xenial-security InRelease [109 kB]
#5 3.669 Get:3 http://security.ubuntu.com/ubuntu xenial-security/main amd64 Packages [2051 kB]
#5 5.891 Get:4 http://archive.ubuntu.com/ubuntu xenial-updates InRelease [109 kB]
#5 6.927 Get:5 http://archive.ubuntu.com/ubuntu xenial-backports InRelease [107 kB]
#5 7.731 Get:6 http://archive.ubuntu.com/ubuntu xenial/main amd64 Packages [1558 kB]
#5 27.07 Get:7 http://security.ubuntu.com/ubuntu xenial-security/restricted amd64 Packages [15.9 kB]
#5 27.10 Get:8 http://security.ubuntu.com/ubuntu xenial-security/universe amd64 Packages [984 kB]
#5 27.40 Get:9 http://archive.ubuntu.com/ubuntu xenial/restricted amd64 Packages [14.1 kB]
#5 27.90 Get:10 http://archive.ubuntu.com/ubuntu xenial/universe amd64 Packages [9827 kB]
#5 33.14 Get:11 http://security.ubuntu.com/ubuntu xenial-security/multiverse amd64 Packages [8820 B]
#5 224.4 Get:12 http://archive.ubuntu.com/ubuntu xenial/multiverse amd64 Packages [176 kB]
#5 235.1 Get:13 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 Packages [2559 kB]
#5 286.1 Get:14 http://archive.ubuntu.com/ubuntu xenial-updates/restricted amd64 Packages [16.4 kB]
#5 286.1 Get:15 http://archive.ubuntu.com/ubuntu xenial-updates/universe amd64 Packages [1544 kB]
#5 300.9 Get:16 http://archive.ubuntu.com/ubuntu xenial-updates/multiverse amd64 Packages [26.2 kB]
#5 300.9 Get:17 http://archive.ubuntu.com/ubuntu xenial-backports/main amd64 Packages [10.9 kB]
#5 300.9 Get:18 http://archive.ubuntu.com/ubuntu xenial-backports/universe amd64 Packages [12.7 kB]
#5 301.0 Fetched 19.4 MB in 4min 59s (64.7 kB/s)
#5 301.0 Reading package lists...
#5 DONE 303.4s

#6 [3/3] RUN apt-get install -y iputils-ping
#6 sha256:ec62f1ae1cd6e472dbc3eacc6090a5dab9f4238a7ac3f70463e9f1220cab3d62
#6 2.446 Reading package lists...
#6 3.184 Building dependency tree...
#6 3.301 Reading state information...
#6 3.399 The following additional packages will be installed:
#6 3.399 libffi6 libgmp10 libgnutls-openssl127 libgnutls30 libhogweed4 libidn11
#6 3.400 libnettle6 libp11-kit0 libtasn1-6
#6 3.401 Suggested packages:
#6 3.401 gnutls-bin
#6 3.401 The following NEW packages will be installed:
#6 3.401 iputils-ping libffi6 libgmp10 libgnutls-openssl127 libgnutls30 libhogweed4
#6 3.402 libidn11 libnettle6 libp11-kit0 libtasn1-6
#6 5.289 0 upgraded, 10 newly installed, 0 to remove and 5 not upgraded.
#6 5.289 Need to get 1307 kB of archives.
#6 5.289 After this operation, 3781 kB of additional disk space will be used.
#6 5.289 Get:1 http://archive.ubuntu.com/ubuntu xenial/main amd64 libgmp10 amd64 2:6.1.0+dfsg-2 [240 kB]
#6 7.560 Get:2 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 libnettle6 amd64 3.2-1ubuntu0.16.04.2 [93.7 kB]
#6 10.86 Get:3 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 libhogweed4 amd64 3.2-1ubuntu0.16.04.2 [136 kB]
#6 12.21 Get:4 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 libidn11 amd64 1.32-3ubuntu1.2 [46.5 kB]
#6 12.23 Get:5 http://archive.ubuntu.com/ubuntu xenial/main amd64 libffi6 amd64 3.2.1-4 [17.8 kB]

```

```

#6 12.55 Get:6 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 libp11-kit0 amd64 0.23.2-5~ubuntu16.04.2 [107 kB]
#6 13.22 Get:7 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 libtasn1-6 amd64 4.7-3ubuntu0.16.04.3 [43.5 kB]
#6 13.45 Get:8 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 libgnutls30 amd64 3.4.10-4ubuntu1.8 [548 kB]
#6 19.44 Get:9 http://archive.ubuntu.com/ubuntu xenial-updates/main amd64 libgnutls-openssl127 amd64 3.4.10-4ubuntu1.8 [21.9 kB]
#6 19.46 Get:10 http://archive.ubuntu.com/ubuntu xenial/main amd64 iputils-ping amd64 3:20121221-5ubuntu2 [52.7 kB]
#6 20.22 debconf: delaying package configuration, since apt-utils is not installed
#6 20.29 Fetched 1307 kB in 16s (78.7 kB/s)
#6 20.86 Selecting previously unselected package libgmp10:amd64.
(Reading database ... 4785 files and directories currently installed.)
#6 20.86 Preparing to unpack .../libgmp10_2%3a6.1.0+dfsg-2_amd64.deb ...
#6 21.17 Unpacking libgmp10:amd64 (2:6.1.0+dfsg-2) ...
#6 22.91 Selecting previously unselected package libnettle6:amd64.
#6 22.91 Preparing to unpack .../libnettle6_3.2-1ubuntu0.16.04.2_amd64.deb ...
#6 23.11 Unpacking libnettle6:amd64 (3.2-1ubuntu0.16.04.2) ...
#6 24.13 Selecting previously unselected package libhogweed4:amd64.
#6 24.13 Preparing to unpack .../libhogweed4_3.2-1ubuntu0.16.04.2_amd64.deb ...
#6 24.36 Unpacking libhogweed4:amd64 (3.2-1ubuntu0.16.04.2) ...
#6 26.22 Selecting previously unselected package libidn11:amd64.
#6 26.22 Preparing to unpack .../libidn11_1.32-3ubuntu1.2_amd64.deb ...
#6 26.39 Unpacking libidn11:amd64 (1.32-3ubuntu1.2) ...
#6 27.59 Selecting previously unselected package libffi6:amd64.
#6 27.59 Preparing to unpack .../libffi6_3.2.1-4_amd64.deb ...
#6 27.78 Unpacking libffi6:amd64 (3.2.1-4) ...
#6 30.04 Selecting previously unselected package libp11-kit0:amd64.
#6 30.04 Preparing to unpack .../libp11-kit0_0.23.2-5~ubuntu16.04.2_amd64.deb ...
#6 30.25 Unpacking libp11-kit0:amd64 (0.23.2-5~ubuntu16.04.2) ...
#6 32.38 Selecting previously unselected package libtasn1-6:amd64.
#6 32.38 Preparing to unpack .../libtasn1-6_4.7-3ubuntu0.16.04.3_amd64.deb ...
#6 32.60 Unpacking libtasn1-6:amd64 (4.7-3ubuntu0.16.04.3) ...
#6 34.93 Selecting previously unselected package libgnutls30:amd64.
#6 34.93 Preparing to unpack .../libgnutls30_3.4.10-4ubuntu1.8_amd64.deb ...
#6 35.14 Unpacking libgnutls30:amd64 (3.4.10-4ubuntu1.8) ...
#6 36.41 Selecting previously unselected package libgnutls-openssl127:amd64.
#6 36.41 Preparing to unpack .../libgnutls-openssl127_3.4.10-4ubuntu1.8_amd64.deb ...
#6 36.60 Unpacking libgnutls-openssl127:amd64 (3.4.10-4ubuntu1.8) ...
#6 38.46 Selecting previously unselected package iputils-ping.
#6 38.46 Preparing to unpack .../iputils-ping_3%3a20121221-5ubuntu2_amd64.deb ...
#6 38.69 Unpacking iputils-ping (3:20121221-5ubuntu2) ...
#6 39.56 Processing triggers for libc-bin (2.23-0ubuntu11.2) ...
#6 41.37 Setting up libgmp10:amd64 (2:6.1.0+dfsg-2) ...
#6 42.28 Setting up libnettle6:amd64 (3.2-1ubuntu0.16.04.2) ...
#6 43.64 Setting up libhogweed4:amd64 (3.2-1ubuntu0.16.04.2) ...
#6 44.34 Setting up libidn11:amd64 (1.32-3ubuntu1.2) ...
#6 45.09 Setting up libffi6:amd64 (3.2.1-4) ...
#6 46.43 Setting up libp11-kit0:amd64 (0.23.2-5~ubuntu16.04.2) ...
#6 47.12 Setting up libtasn1-6:amd64 (4.7-3ubuntu0.16.04.3) ...
#6 47.78 Setting up libgnutls30:amd64 (3.4.10-4ubuntu1.8) ...
#6 48.51 Setting up libgnutls-openssl127:amd64 (3.4.10-4ubuntu1.8) ...
#6 49.93 Setting up iputils-ping (3:20121221-5ubuntu2) ...
#6 50.33 Setcap is not installed, falling back to setuid
#6 50.53 Processing triggers for libc-bin (2.23-0ubuntu11.2) ...
#6 DONE 52.1s

#7 exporting to image
#7 sha256:e8c613e07b0b7ff33893b694f7759a10d42e180f2b4dc349fb57dc6b71dcab00
#7 exporting layers
#7 exporting layers 2.5s done
#7 writing image sha256:c20de1acd604dd4334faad198b95718e2b7475c2607f6770c7a5bd3459cea427
#7 writing image sha256:c20de1acd604dd4334faad198b95718e2b7475c2607f6770c7a5bd3459cea427 0.1s done
#7 naming to docker.io/delner/ping
#7 naming to docker.io/delner/ping 0.3s done
#7 DONE 3.3s

```

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to fix them

```
tingc@DESKTOP-GCII9EB MINGW64 ~
```

```
$ docker images
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
delner/ping	latest	c20de1acd604	12 minutes ago	170MB
ubuntu	16.04	9ff95a467e45	3 weeks ago	135MB

```
tingc@DESKTOP-GCII9EB MINGW64 ~
$ docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
delner/ping    latest    c20de1acd604   12 minutes ago 170MB
ubuntu        16.04     9ff95a467e45   3 weeks ago   135MB

tingc@DESKTOP-GCII9EB MINGW64 ~
$ docker build -t 'delner/ping' ./
#1 [internal] load build definition from Dockerfile
#1 sha256:f726c9ffff86892b96f3472cafdbaa286c996fac72e184b10b26db8ea960fea73
#1 transferring dockerfile: 31B 0.0s done
#1 DONE 0.6s

#2 [internal] load .dockerignore
#2 sha256:3f0809ea4f39f235d806700af620ce6d95d411e447bc1003398ab02dc908d586
#2 transferring context: 2B 0.0s done
#2 DONE 0.8s

#3 [internal] load metadata for docker.io/library/ubuntu:16.04
#3 sha256:8dff2c23d5907ba94f7c361d130cc16c98c9f3ad54aa1c116e150ea96355a327
#3 DONE 0.0s

#4 [1/3] FROM docker.io/library/ubuntu:16.04
#4 sha256:04187b885604d112762d71717a1346cbc4f17e131fc82857a048019e04951455
#4 DONE 0.0s

#5 [2/3] RUN apt-get update
#5 sha256:d85b94c23f2207314e65c2b65f8174fe8e9f9a171cdda392eb5b3a6093800fe1
#5 CACHED

#6 [3/3] RUN apt-get install -y iputils-ping
#6 sha256:ec62f1ae1cd6e472dbc3eacc6090a5dab9f4238a7ac3f70463e9f1220cab3d62
#6 CACHED

#7 exporting to image
#7 sha256:e8c613e07b0b7ff33893b694f7759a10d42e180f2b4dc349fb57dc6b71dcab00
#7 exporting layers done
#7 writing image sha256:c20de1acd604dd4334faad198b95718e2b7475c2607f6770c7a5bd3459cea427
#7 writing image sha256:c20de1acd604dd4334faad198b95718e2b7475c2607f6770c7a5bd3459cea427 0.1s done
#7 naming to docker.io/delner/ping done
#7 DONE 0.5s

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to fix them

tingc@DESKTOP-GCII9EB MINGW64 ~
$ docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
delner/ping    latest    c20de1acd604   13 minutes ago 170MB
ubuntu        16.04     9ff95a467e45   3 weeks ago   135MB
```

IV. Optimizing the Dockerfile

```

1 FROM ubuntu:16.04
2 LABEL author="David Elner"
3
4 RUN apt-get update
5
6 RUN apt-get install -y iputils-ping
7
8 RUN apt-get clean \
9     && cd /var/lib/apt/lists && rm -fr *Release* *Sources* *Packages* \
10    && truncate -s 0 /var/log/*log
```

```

tingc@DESKTOP-GCII9EB MINGW64 ~
$ docker build -t 'delner/ping' .
#2 [internal] load .dockerignore
#2 sha256:546728300a512925a524b83e755b8e4a53b678f23674d30b6d1a6e9f93116248
#2 ...

#1 [internal] load build definition from Dockerfile
#1 sha256:29a95f2b55793a089debe6b8bf7e70717703179245b2f0193eb872dc9bed9e2
#1 transferring dockerfile: 271B 0.1s done
#1 DONE 1.0s

#2 [internal] load .dockerignore
#2 sha256:546728300a512925a524b83e755b8e4a53b678f23674d30b6d1a6e9f93116248
#2 transferring context: 2B 0.0s done
#2 DONE 1.8s

#3 [internal] load metadata for docker.io/library/ubuntu:16.04
#3 sha256:8dff2c23d5907ba94f7c361d130cc16c98c9f3ad54aa1c116e150ea96355a327
#3 DONE 0.0s

#7 [1/4] FROM docker.io/library/ubuntu:16.04
#7 sha256:04187b885604d112762d71717a1346cbc4f17e131fc82857a048019e04951455
#7 DONE 0.0s

#4 [2/4] RUN apt-get update
#4 sha256:d85b94c23f2207314e65c2b65f8174fe8e9f9a171cdda392eb5b3a6093800fe1
#4 CACHED

#5 [3/4] RUN apt-get install -y iputils-ping
#5 sha256:ec62f1ae1cd6e472dbc3eacc6090a5dab9f4238a7ac3f70463e9f1220cab3d62
#5 CACHED

#6 [4/4] RUN apt-get clean && cd /var/lib/apt/lists && rm -fr *Release* *Sources* *Packages* && truncate -s 0 /var/log/*log
#6 sha256:3f43f39155c298a234ff8a89032d3284c1268833c27366b07e8c30a408fac3c6
#6 DONE 1.9s

#8 exporting to image
#8 sha256:e8c613e07b0b7ff33893b694f7759a10d42e180f2b4dc349fb57dc6b71dcab00
#8 exporting layers
#8 exporting layers 2.4s done
#8 writing image sha256:541245d1b0229ad76210087c56a573d59e7c25ef8dddbbd29178dad0c00fde02 0.1s done
#8 naming to docker.io/delner/ping
#8 naming to docker.io/delner/ping 0.3s done
#8 DONE 3.1s

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to fix them

tingc@DESKTOP-GCII9EB MINGW64 ~
$ docker images

```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
delner/ping	latest	541245d1b022	12 seconds ago	170MB
<none>	<none>	c20de1acd604	18 minutes ago	170MB
ubuntu	16.04	9ff95a467e45	3 weeks ago	135MB

```

1 FROM ubuntu:16.04
2 LABEL author="David Elner"
3
4 RUN apt-get update \
5     && apt-get install -y iputils-ping \
6     && apt-get clean \
7     && cd /var/lib/apt/lists && rm -fr *Release* *Sources* *Packages* \
8     && truncate -s 0 /var/log/*log

```

```

tingc@DESKTOP-GCII9EB MINGW64 ~
$ docker images

```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
delner/ping	latest	3878f67f1b98	42 seconds ago	139MB
<none>	<none>	541245d1b022	7 minutes ago	170MB
<none>	<none>	c20de1acd604	26 minutes ago	170MB
ubuntu	16.04	9ff95a467e45	3 weeks ago	135MB

V. Other Dockerfile derivatives

```
tingc@DESKTOP-GCII9EB MINGW64 ~  
$ docker run delner/ping  
PING google.com (172.217.174.206) 56(84) bytes of data.  
64 bytes from 172.217.174.206: icmp_seq=1 ttl=37 time=47.1 ms  
64 bytes from 172.217.174.206: icmp_seq=2 ttl=37 time=48.5 ms  
64 bytes from 172.217.174.206: icmp_seq=3 ttl=37 time=78.2 ms  
64 bytes from 172.217.174.206: icmp_seq=4 ttl=37 time=47.4 ms  
64 bytes from 172.217.174.206: icmp_seq=5 ttl=37 time=48.0 ms  
|
```